٣م ، محاضرة ٨

٢٠١٨/٥/١٠

Comparison between alternatives
مقارنة البدائل

[1] By present worth method [Pw]
[2] By Annual worth method [Aw]

[1] By Pw method

* If two Projects are same service life, we can use [Pw] method in comparison.
* If they different in service life, use only [Aw] method.

Ex:- Compare bet. the two electrical motors at i=10% and energy cost is 0.05 $/Kwatt.

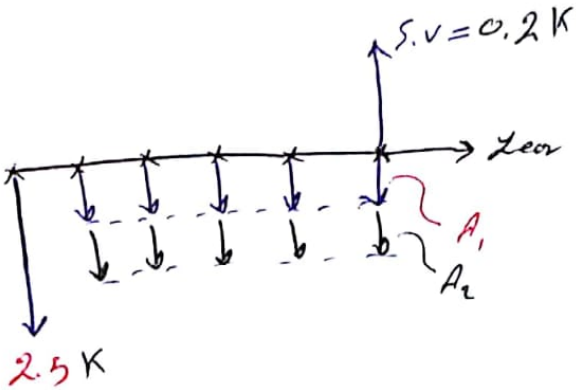
	Motor A	Motor B
initial cost $	2.5 K	3.5 K
AOC $/year	0.9K	0.7 K
Energy Consumation Kwatt/year	10^4	9200
S. value $	200	300
life(year)	5	5

Solution

38.

Solution

Motor A



let $A_1 = 0.9\ \$/year$

let A_2 = Energy cost

$$= 10^4 \frac{Kwatt}{year} * \frac{0.05\ \$}{Kwatt} = 500\ \$/year$$

$$P_W(10\%)^{(A)} = -2.5 - (A_1 + A_2)[P/A, 10\%, 5] + S.V[P/F, 10\%, 5]$$

$$P_W(10\%)^{(A)} = -7683\ \$$$

Similarly :-

for $P_W(10\%)^{(B)} = -7711\ \$$

Since $P_W^{(A)} < P_W^{(B)} \Rightarrow$ select (A) motor

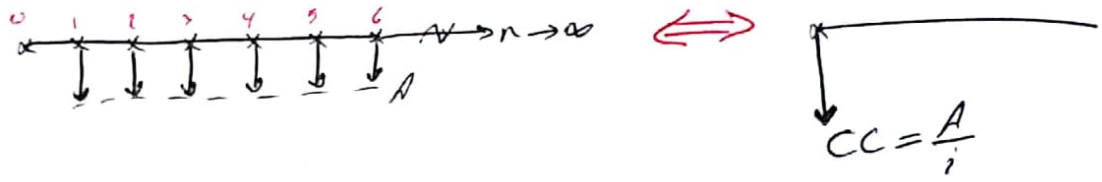
Capitalized Cost :- CC

CC is Pw for Projects which is assumed to be Perpetial [$n \to \infty$].

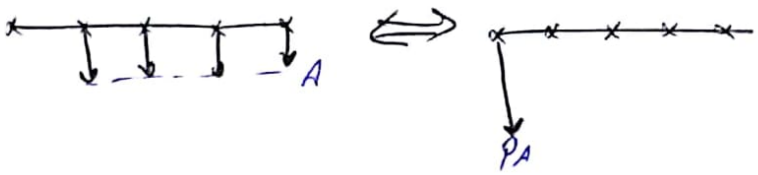
These Projects like [dam, bridge, air Port, hospital, rail road, ----].

$$\left[CC = \frac{A}{i} \right]$$

if we have :-



devivation

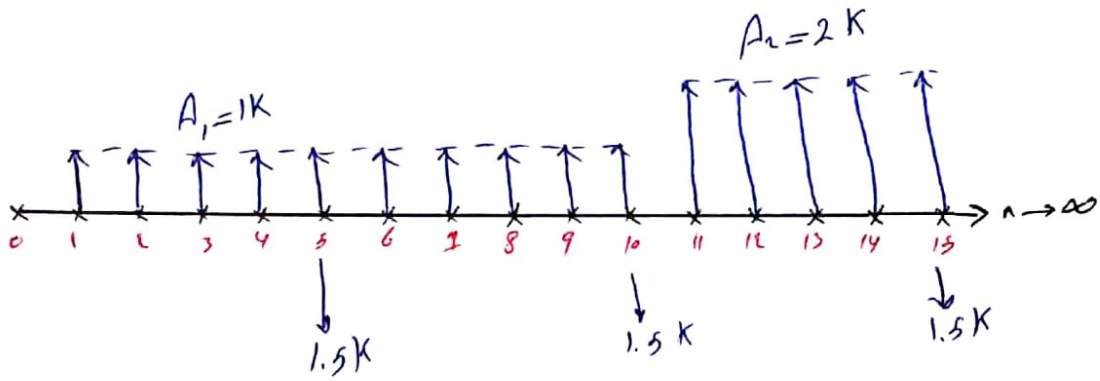


اذا تنقاى به مطلوب

$$P_A = A\left[\frac{(1+i)^n - 1}{i(1+i)^n} \right] \quad \div (1+i)^n$$

$$CC = A\left[\frac{1 - \frac{1}{(1+i)^n}}{i} \right] = \frac{A}{i}$$

Ex:- Find P_W of the cash flow at $i = 10\%$.

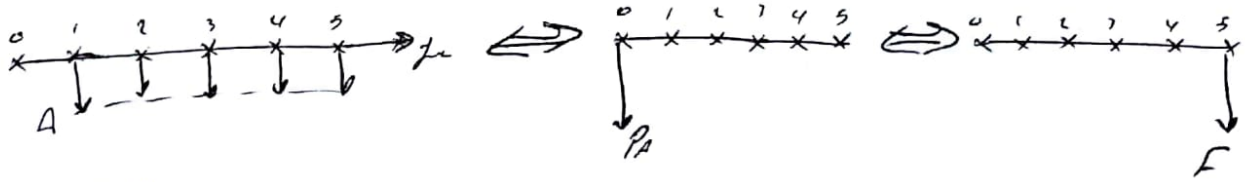


Solution:-

$A_1 = 1K$ \$/year $[n=1 \rightarrow n=10]$.

$A_2 = 2K$ \$/year $[n=11 \rightarrow n \rightarrow \infty]$

For A_3 [1.5K at each 5 year]



$$P_A = A\left[\frac{(1+i)^5 - 1}{i(1+i)^5}\right]$$

$$F = P_A[1+i]^5 = A\left[\frac{(1+i)^5-1}{i(1+i)^5}\right] * (1+i)^5$$

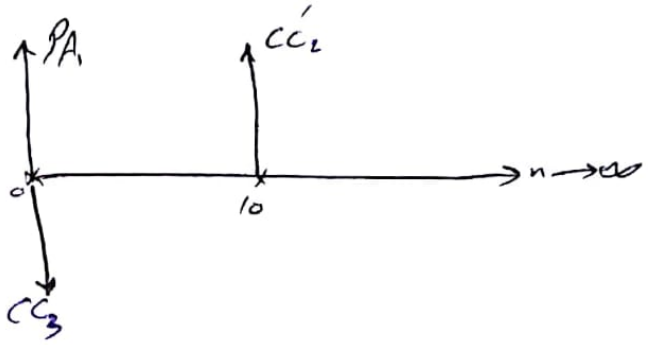
$$\therefore F = A\left[\frac{(1+i)^n - 1}{i}\right]$$

$$\therefore A/F = \left[\frac{i}{(1+i)^n - 1}\right]$$

$$\therefore A_3 = F\left[\frac{i}{(1+i)^5 - 1}\right] = 1.5K\left[\frac{0.1}{(1.1)^5 - 1}\right] = 0.246 \text{ \$/year}$$

$A_3 = 0.246$ \$/year for $[n=1 \rightarrow n=\infty]$

c.n/o/1o



$$\therefore PW(10\%) = PA_1 + \frac{CC'_2}{(1+i)^{10}} - CC_3$$

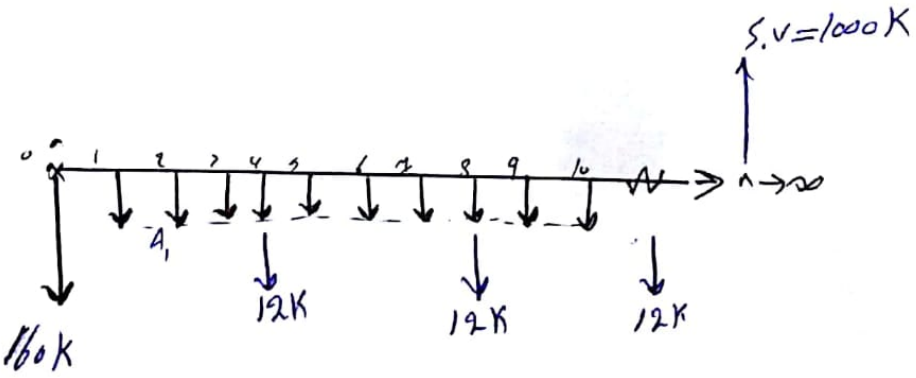
$$= A_1\left[\frac{(1+i)^{10}-1}{i(1+i)^{10}}\right] + \frac{A_2/i}{(1+i)^{10}} - \frac{A_3}{i} = 11.39\ K$$

Ex:- Compare the Project $i = 15\%$

	Project A	Project B
initial cost $	160K	50 K
AoC $/year	15K	31K
overhaul maint. every 4 year	12 K	—
S.V $	1000K	4K
life year	∞	∞ cyclic

Solution

Project A



$A_1 = AOC = 15K$ ₱/year

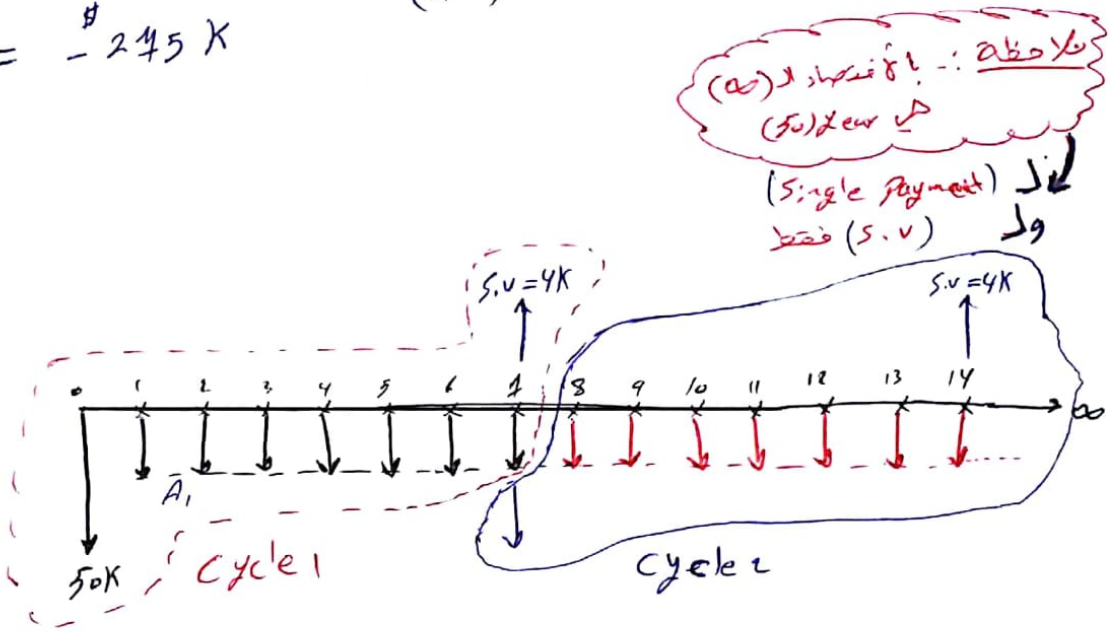
$A_2 = 12K\,[A/F, 15\%, 4] = 12\left[\frac{i}{(1+i)^4 - 1}\right] = 2.403K$ ₱/year

$PW^{(A)}(15\%) = -160K - \frac{\{A_1 + A_2\}}{i} + \frac{S.V}{(1+i)^{50}}$

$PW(15\%) = -275K$ ₱

Project B :-

$A_1 = 31K$ ₱/year



$A_2 = -50K\,[A/P, 15\%, 4] = -12.018K$ ₱/year

$A_3 = +S.V\,[A/F, 15\%, 4] = +0.361K$ ₱/year

$CC = \frac{+A_3 - A_2 - A_1}{i} = \frac{0.361 - 12.018 - 31}{0.15}$

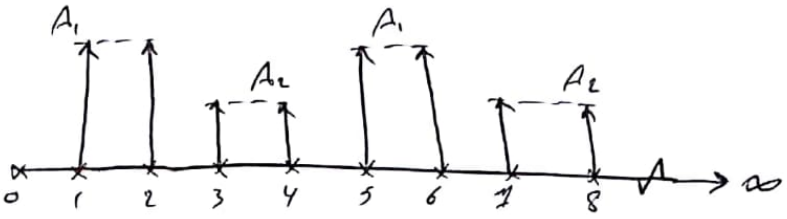
$\therefore CC = -285K$ ₱

Since $PW^{(B)} < PW^{(A)}$ select B

H.w

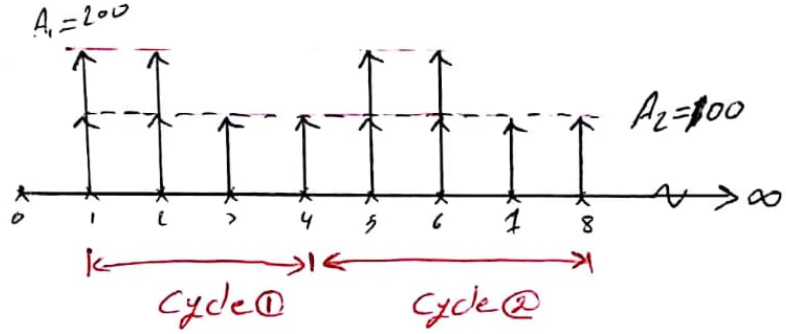
$A_1 = 200$ $/year
$A_2 = 100$ $/year
$i = 10\%$

Find P_W of this Project



Ans 1547 $

Solution :-



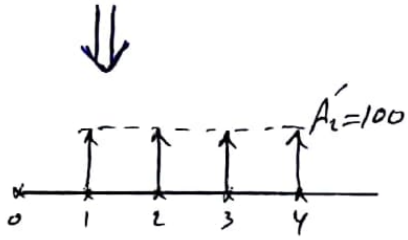
$$P_{A_2} = 100\left(\frac{(1+i)^2-1}{i(1+i)^2}\right)$$

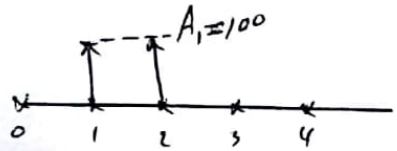
$$= 173.5537\ \$$$

$$A_2 = P_{A_2}\left(\frac{i(1+i)^4}{(1+i)^4-1}\right)$$

$$= 173.5537\left(\frac{0.1(1.1)^4}{(1.1)^4-1}\right)$$

$$= 54.7511\ \$$$

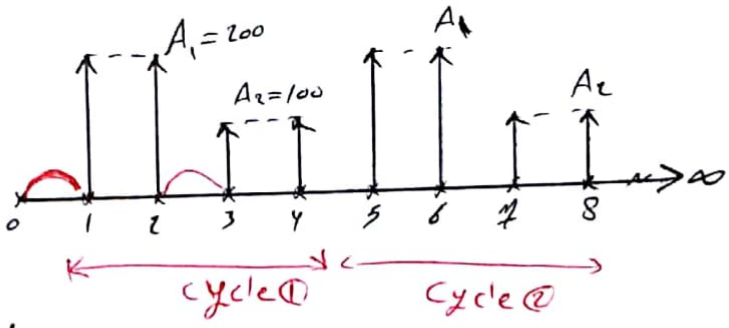




$$P_W = \frac{A_1 + A_2}{i}$$

$$= \frac{100 + 54.7511}{0.1} = 1547\ \$$$

H.W طريقة ثانية



$$P_{A_1} = A_1\left[\frac{(1+i)^2-1}{i(1+i)^2}\right]$$

$$= 200\left[\frac{(1.1)^2-1}{0.1(1.1)^2}\right] = 347.1 \ \$$$

$$P'_{A_2} = 100\left[\frac{(1.1)^2-1}{0.1(1.1)^2}\right] = 173.55 \ \$$$

$$P_{A_2} = \frac{P'_{A_2}}{(1+i)^2}$$

$$= \frac{173.55}{(1+i)^2} = 143.432 \ \$$$

$$P_T = P_{A_1} + P_{A_2} = 490.54 \ \$$$

$$A = P_T\left(\frac{i(1+i)^n}{(1+i)^n-1}\right) \qquad n=4 \Rightarrow \text{cycle①}$$

$$A = 490.54\left(\frac{0.1(1.1)^4}{(1.1)^4-1}\right) = 154.74$$

$$P_W(10\%) = \frac{A}{i} = \frac{154.74}{0.1} = 1547$$

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[2] Annual worth method AW

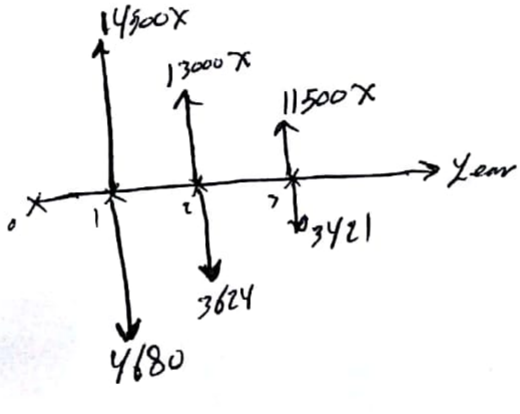
Convert all cash flow to uniform series equivelent [i.e find A $/year].
this used in case of comparison between 2 Projects of different life.

Ex: At $i = 12\%$ what should be the min. remted (إيجار) value of a Pickup in $/Km ?

information

Year	estimated distance (Km)	operating cost $
1	14500	4680
2	13000	3624
3	11500	3421

Solution



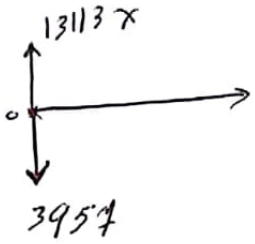
let x be the min. remted value in $/Km

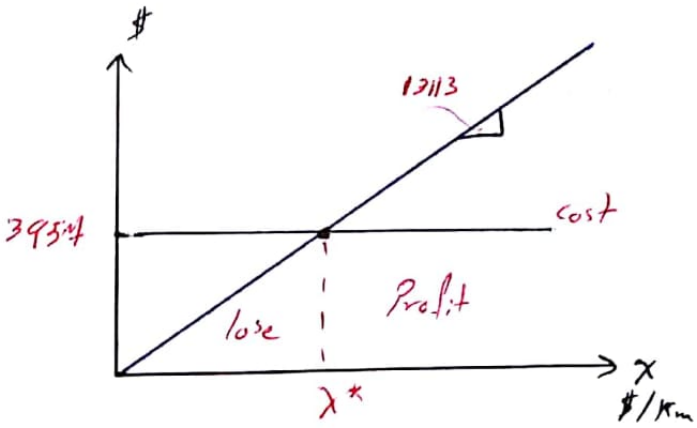
$$PW(12\%)^{cost} = \frac{4680}{(1+i)^1} + \frac{3624}{(1+i)^2} + \frac{3421}{(1+i)^3}$$

$$= 3957 \ \$$$

$$PW(12\%)^{Revenue} = \frac{14500x}{(1+i)^1} + \frac{13000x}{(1+i)^2} + \frac{11500x}{(1+i)^3}$$

$$= 13113 \ x \quad \$$$





at x^*

$P_w^{cost} = P_w^{Revenue}$

$3957 = 13113\, x^*$

$x^* = \frac{3957}{13113} = 0.302$ $/Km

Q/ if the manager to make 40% Profit find the value of x ?

$(1+\frac{40}{100}) = 1.4$

$\therefore x = 1.4\, x^* = 1.4(0.302) = 0.423$ $/Km

٢٠١٨/٥/١٦ - اقتصاد هـ/٤

نقطة التقاطع

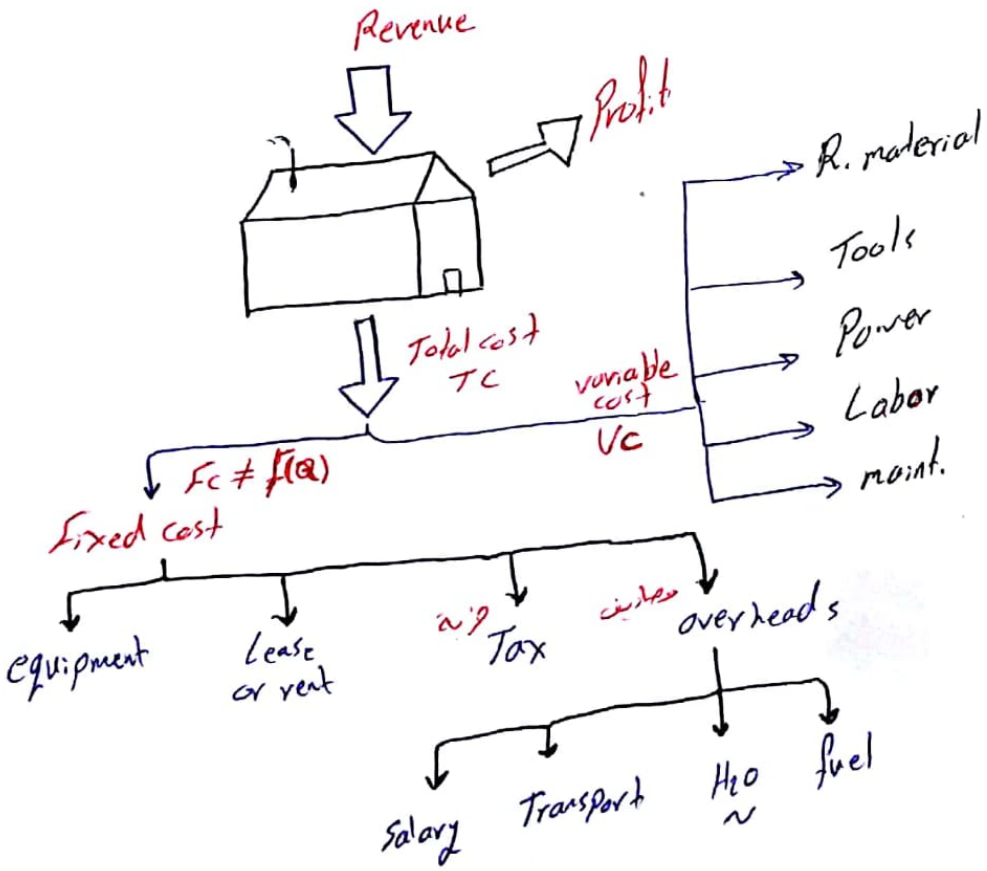
Breakeven analysis

Always Maneger asks "when I Breakeven ?"

Ans When [Revenue = Total cost].

Breakeven is a decision tool related Revenue, Total cost, Profit with Production size Q.

Types of cost ..



Symbols in analysis

R = Revenue $

F_c = Fixed cost $

V_c = Total variable cost $

T_c = Total cost $

P = Profit $

Q = Production size units.

Q_{BE} = Productio size at Break even units

CM = Contribution margin $

CMV = Contribution margin /unit $/unit

$CM\%$ = Contribution margin as %

r = Selling Price per unit $/unit

v = Cost per each unit $/unit

Equation of B. even

1- Total revenue $R = r \cdot Q$ ---①

2- T. Variable cost $V_c = v \cdot Q$ ---②

3- Total cost $T_c = F_c + V_c$

$\therefore T_c = F_c + vQ$ ---③

4- Profit $P = R_{evenue} - T_c$

$P = R - T_c = rQ - [F_c + vQ]$

$\therefore P = [r - v]Q - F_c$ ----④

5- $CM = [r - v]Q$ ----⑤

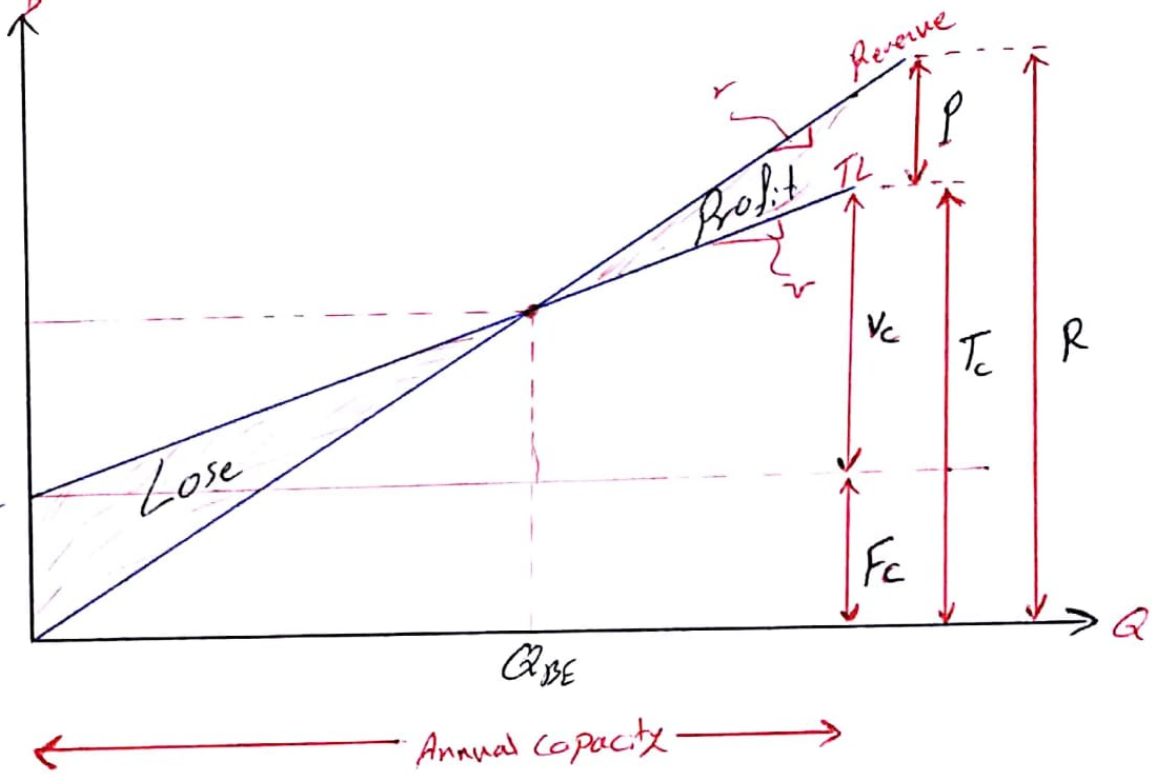
6- $CMV = \frac{CM}{Q} = r - v$ ----⑥

7- $CM\% = \frac{CM}{R} = \frac{r - v}{r}$ ---⑦

CVP chart

Cost
R
P

Cost Volume Profit



at Break even Point Q_{BE} [$T_c = R$]

$R = T_c$

$rQ_{BE} = F_c + vQ_{BE}$

$\therefore \left[Q_{BE} = \frac{F_c}{r - v} \right]$

Example:

A manual Operated Production m/c Costs [$60K, 7 yrs, $5K as S.value] with annual operating Cost of 2000 $/yr.

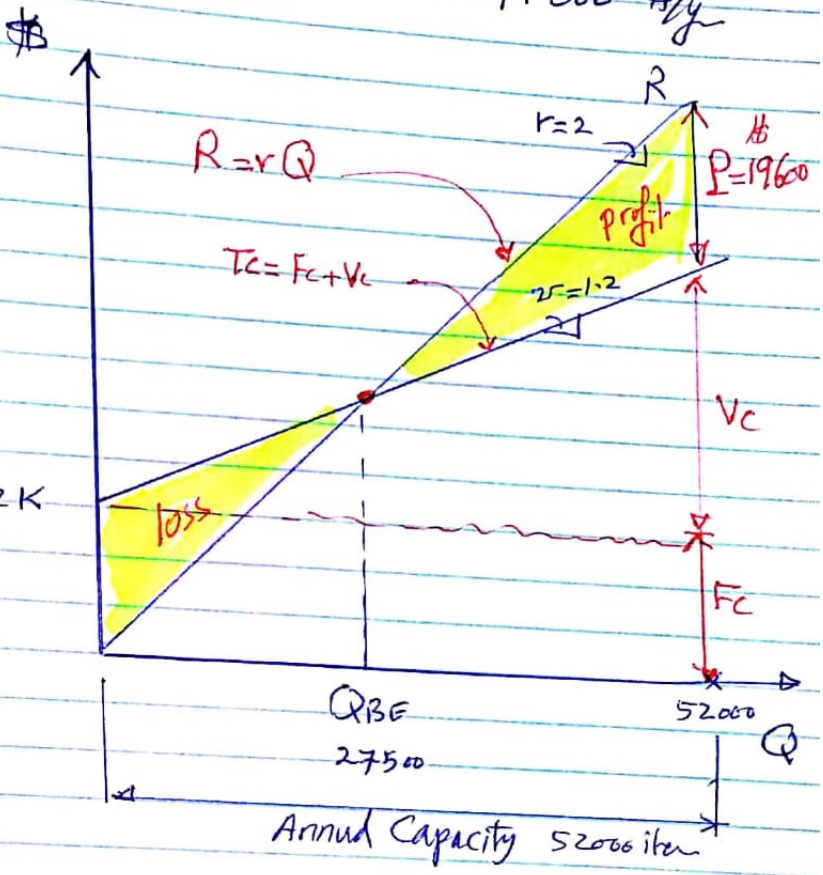
- with these specifications: [Production rate is 25 item/hr, Cost of labor is 10 $/hr, with material cost 0.8 $/item]
- Other overheads: [lease of space is 1000 $/yr, Tax & insurance is 550 $/yr, with other disbursement by 530 $/yr.]
- The m/c estimated to operate 8 hr/day, 5 days/week, for 52 weeks/yr.
- Each unit produced can be sold by 2 $/unit.

Required:

(1) Make Breakeven analysis draw CVP, VP charts and find annual Profit at i = 20%.

(2) If the price of each unit can be increased 10% per item, what is the new QBE Point and annual Profit.

$$CM = [r - v]Q = [2 - 1.2] * 52000 = 41600 \text{ \#/y}$$



if r increase 10%

so $r = 2 * 1.1 = 2.2$ \#/unit $Fc = 22K$

$$Q_{BE} = \frac{Fc}{r - v} = \frac{22000}{2.2 - 1.2}$$

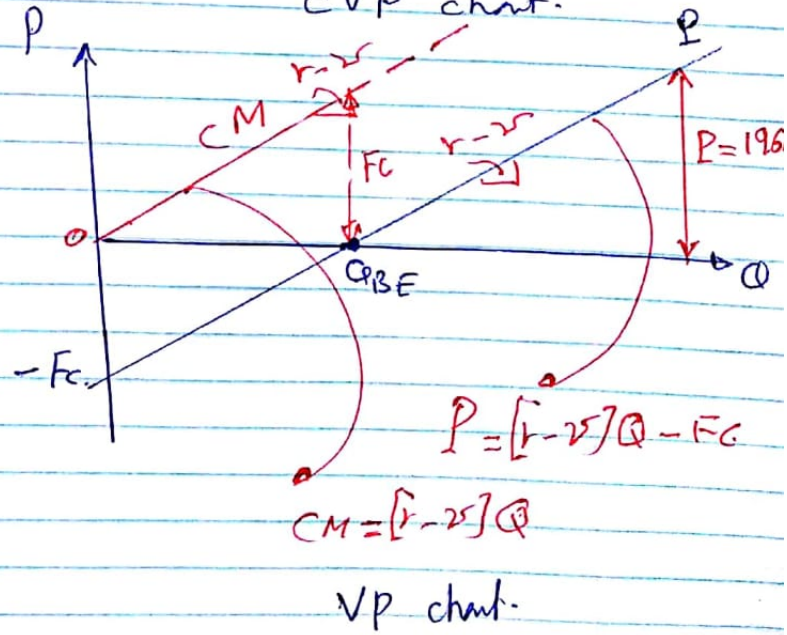
$$\therefore Q_{BE} = 22000$$

$$P = [r - v]Q - Fc$$

$$= [2.2 - 1.2]52000 - 22000$$

$$P = 30{,}000 \text{ \#/y}$$

(2)



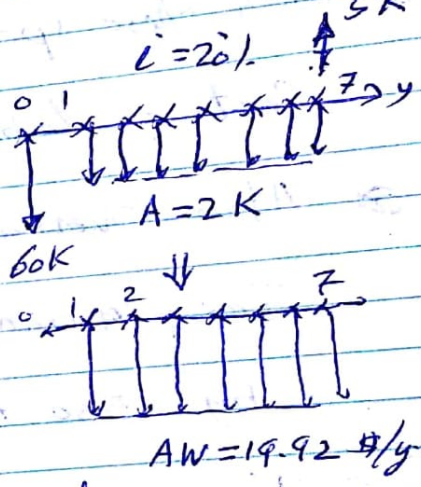
Solution: $r = 2$ \$/unit.

v = cost of labor/unit + Cost of R.m/unit

$= \frac{10\ \$/hr}{25\ item/hr} + 0.8 = 0.4 + 0.8 = 1.2$ \$/unit

$AW(20\%) = -2 - 60[A/p, 20\%, 7] + 5K[A/F, 20\%, 7]$

$= 19.92K$ \$/y



$Fc = AW$ \$/y + lease + Tax + disbursmt.

$Fc = 19920 + 1800 + 550 + 530 = 22000$ \$/y

$Q_{BE} = \frac{Fc}{r - v} = \frac{22000}{2 - 1.2} = 27500$ unit.

Annual Capacity:

$25\ \frac{item}{hr} * 8\ \frac{hr}{day} * 5\ \frac{day}{week} * 52\ \frac{week}{y} = 52000$ unit/y

$Profit = [r - v]Q - Fc$

$= [2 - 1.2] * 52000 - 22000 = 19600$ \$/y